Identifying White Dwarf Candidates

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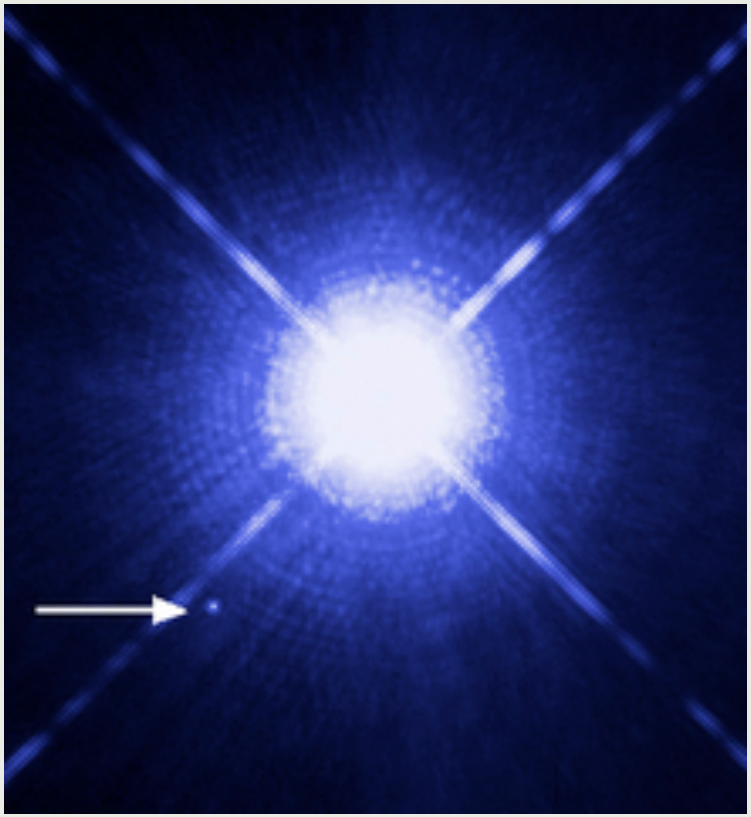


Why we care about White Dwarfs (WDs)

- WDs are the last phase of a massive stars life
  - What's left over after a Supernova
  - Continual cooling over time
- Particularly interesting and unknown physics related to WDs
  - What is the core made out of?
  - Temperature of a WD gives age of star clusters
  - Electron degenerate matter – electrons are packed into lowest state
  - Very dense (10^9 kg/m^3) and high gravity (10^8 m/s^2)
- Finding new WDs is the first step to learning more about them and how they work

1. Data Extraction

- HSOY – Proper Motion Survey
  - Provides proper motion data on GAIA targets
    - Proper Motion – change in an object's coordinates as a function of time. Typical units of milliarcseconds/year.
  - Contains 583 million objects
  - Only using objects with significant proper motion
- SDSS – Photometric Survey
  - Contains visible photometry for the targets
    - Photometry – related to the energy flux from the object over a certain range of wavelength
  - 1.2 billion objects

2. Reduced Proper Motion Diagram

- Reduced proper motion is based on photometric magnitude and tangential velocity
- Forms clusters on diagram with similar kinematics
- Far right cluster – Main sequence
  Middle cluster – Halo stars
  Left cluster – WDs

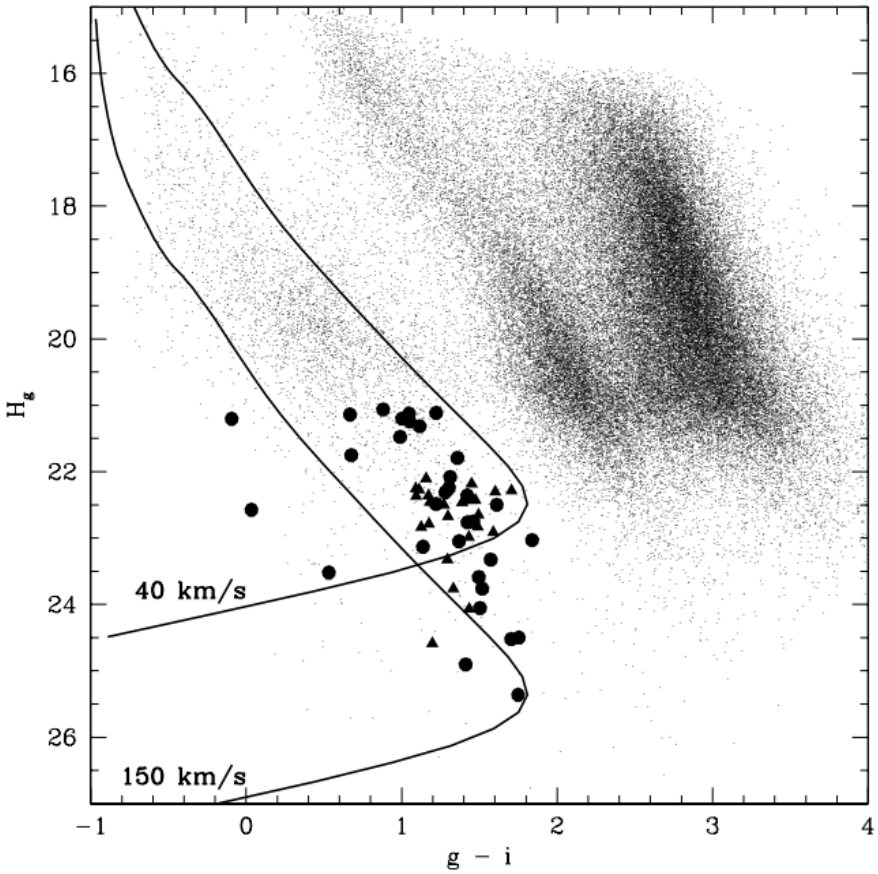
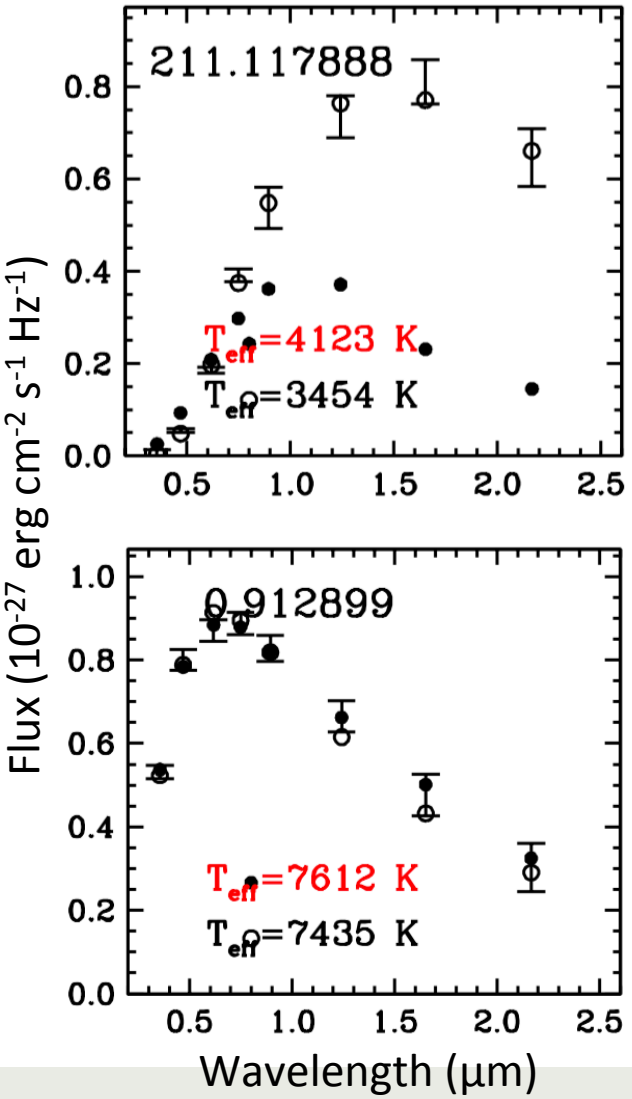


Image from Dame, K. (2016)

3. Fitting Photometric Data to Models

- Fit photos and fit output tell us likely composition and temperature of stars
- Top image – Helium based @ 3454K (likely not a WD)
  Bottom image – Hydrogen based @ 7612K
- Specific interest in Hydrogen based WDs below 4000K due to age and rarity



Conclusion

- White Dwarfs are a gold mine for interesting physics, and identifying them is the first step to studying them.
- Using optical data and positional data, it is possible to identify white dwarf candidates
- Two more types of data are needed to definitively identify a WD:
  - Photometry in the infrared to get a more accurate temperature estimation
  - A spectrum will show large gravitationally expanded lines and confirm that object is a white dwarf